SAMQUA - A Program for Generating All Possible Combinations of Quantum Numbers Leading to the Same Compound Nucleus State in the Framework of the R-Matrix Code SAMMY.

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This paper reports the results of a collaborative effort between CEA of France and the DOE of the United States (in particular between le Laboratoire d'Etudes de Physique de Cadarache and the Nuclear Data and Information Analysis Group at Oak Ridge National Laboratory): In preparing input for analyses of differential nuclear data using multilevel multi-channel R-matrix theory, a sometimes daunting and often error-prone task is the generation of quantum-number information for all channels for each compound nuclear state (i.e., for each "spin group", defined by quantum numbers J^π). For many years, the code SAMQUA has been available to users of the R-matrix code SAMMY to assist in preparation of that input; the original SAMQUA code, however, was limited to single-channel spin group information. In this paper, an improved version of the SAMQUA code is described. The new SAMQUA permits inclusion of all open reaction channels in the low-energy interaction between one particle (neutron or charged particle) and a nuclear target, and considerably simplifies the determination of the quantum numbers needed for the definition of the reaction channels. SAMQUA, in addition to its primary function of preparing quantum numbers for the SAMMY input file, also provides the possibility to visualize immediately all open reaction channels. This paper gives also several examples of the use of SAMQUA, with emphasis on the notions of reaction channels and penetrability.

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